Claims

1. A proprotor hub for a tiltrotor aircraft, the hub comprising:

a central member;

a plurality of blade attachment members adapted for attaching proprotor blades to the central member, the blade attachment members being pivotally attached to the central member for pivoting about a pivot axis generally normal to a plane of rotation of the blades, the pivoting allowing for in-plane motion of the blades relative to the central member; and

a damper operably connected to each blade attachment member for damping the in-plane motion of the associated blade, each damper being selectively switchable between at least first and second spring rates.

2. The hub according to claim 1, further comprising:

a bearing operably connecting each blade attachment member to the central member;

wherein the pivot axis of each blade attachment member passes through a focus of the associated bearing.

3. The hub according to claim 2, wherein the bearing is an elastomeric bearing.

4. The hub according to claim 1, further comprising:

at least one pin pivotally connecting each blade attachment member to the central member;

wherein the pivot axis of each blade is coaxial with the associated at least one pin.

5. The hub according to claim 1, wherein each damper is selectively switched from the first spring rate to the spring damping rate upon landing of the aircraft.

6. The hub according to claim 5, wherein the second spring rate is stiffer than the first spring rate.

7. The hub according to claim 1, wherein each damper is selectively switched from the second spring rate to the first spring rate upon takeoff of the aircraft.

8. The hub according to claim 7, wherein the first spring rate is softer than the second spring rate.

9. A soft in-plane proprotor assembly for a tiltrotor aircraft, the assembly comprising:

a central member;

a plurality of proprotor blades;

a plurality of blade attachment members, each member attaching one of the blades to the central member, the blade attachment members being pivotally attached to the central member and capable of pivoting about a pivot axis generally normal to a plane of rotation of the blades, the pivoting allowing for in-plane motion of the blades relative to the central member; and

a damper operably connected to each blade attachment member for damping the in-plane motion of the associated blade, each damper being selectively switchable between at least first and second spring rates.

10. The proprotor assembly according to claim 9, further comprising:

a bearing operably connecting each blade attachment member to the central member;

wherein the pivot axis of each blade attachment member passes through a focus of the associated bearing.

11. The proprotor assembly according to claim 10, wherein the bearing is an elastomeric bearing.

12. The proprotor assembly according to claim 9, further comprising:

at least one pin pivotally connecting each blade attachment member to the central member;

wherein the pivot axis of each blade is coaxial with the associated at least one pin.

13. The proprotor assembly according to claim 9, wherein each damper is selectively switched from the first spring rate to the second spring rate upon landing of the aircraft.

14. The proprotor assembly according to claim 13, wherein the second spring rate is stiffer than the first spring rate.

15. The proprotor assembly according to claim 9, wherein each damper is selectively switched from the second spring rate to the first spring rate upon takeoff of the aircraft.

16. The proprotor assembly according to claim 15, wherein the first spring rate is softer than the second spring rate.

17. A rotor hub assembly for a rotary-wing aircraft, comprising:

a central member;

a plurality of blade grips adapted for attaching rotor blades to the central member, the blade grips being pivotally attached to the central member and capable of pivoting about a pivot axis generally normal to a plane of rotation of the blades, the pivoting allowing for in-plane motion of the blades relative to the central member; and

a damper operably connected to each blade grip for damping the in-plane motion of the associated blade, each damper being selectively switchable between at least two spring rates.

18. A proprotor assembly for a tiltrotor aircraft, the assembly comprising:

a central member;

a plurality of blade attachment members;

a plurality of blades;

a flapping hinge connecting an inner portion of each blade attachment member to the central member, each flapping hinge having an axis generally parallel to a plane of rotation of the assembly and providing for out-of plane motion of the corresponding blade attachment member; and

a lead/lag hinge connecting each blade to the blade attachment member, each lead/lag hinge having an axis generally normal to the plane of rotation of the assembly and providing for in-plane motion of the blade relative to the blade attachment member; and wherein

the axes are non-coincident.

19. The proprotor assembly according to claim 18, further comprising:

a blade strap that encircles each flapping hinge and a bearing of the associated lead/lag hinge.

20. The proprotor assembly according to claim 19, wherein the blade strap is oriented to extend out of the plane of rotation of the assembly.

21. The proprotor assembly according to claim 18, further comprising:

a damper operably connected to each blade attachment member for damping the in-plane motion of the associated blade, each damper being selectively switchable between at least first and second spring rates.

22. A proprotor assembly for a tiltrotor aircraft, the assembly comprising:

a central member;

a plurality of blade attachment members;

a plurality of blades;

a flapping hinge connecting an inner portion of each blade attachment member to the central member, each flapping hinge having an axis generally parallel to a plane of rotation of the assembly and providing for out-of plane motion of the corresponding blade attachment member;

a lead/lag hinge connecting each blade to the blade attachment member, each lead/lag hinge having an axis generally normal to the plane of rotation of the

assembly and providing for in-plane motion of the blade relative to the blade attachment member, the axes being non-coincident; and a blade strap that encircles each flapping hinge and a bearing of the associated lead/lag hinge.

23. A method for damping in-plane motion of blades of an aircraft rotor, the method comprising the steps of:

attaching blade attachment members to a central member, the blade attachment members being pivotable about an axis generally normal to a plane of rotation of the central member;

attaching a rotor blade to each blade attachment member, each blade being capable of in-plane movement relative to the central member;

operably connecting each blade attachment member to a damper for damping in-plane motion of the associated blade, each damper being selectively switchable between at least two spring rates;

switching each damper to achieve a selected in-plane stiffness.